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Akimasa Tanaka

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EXAMINER

GARRITY, DIANA C

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/594,619	<b>Applicant(s)</b> TANAKA, AKIMASA	
	<b>Examiner</b> DIANA C. GARRITY	<b>Art Unit</b> 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 30 May 2008.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 11-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 September 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>9/28/06</u> .   | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Status of the Claims***

**1. Election filed May 30, 2008 is acknowledged. Claims 11-20 are withdrawn from consideration.** Below is the examination of claims 1-10.

### ***Election/Restrictions***

**2. Applicant's election without traverse of Group I, claims 1-10 in the reply filed on May 30, 2008 is acknowledged.**

Applicant's election of Group I in the reply filed on May 30, 2008 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

### ***Specification***

**3. The disclosure is objected to because of the following informalities:**

- Paragraph 49: states that contact electrode takes "electrodes" from the photodetecting region.
- Paragraph 50: states that silicon oxide is SiO<sub>2</sub>. According to standard practice, silicon oxide is SiO, and silicon dioxide is SiO<sub>2</sub>.
- The words "photodiode," "photodetect," and "photodetection" are misspelled in numerous places throughout the disclosure.

Appropriate correction is required.

**4. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors.** Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

**5. The title of the invention is not descriptive.** A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Semiconductor light detecting element includes film which covers light receiving region near main surface of multilayer structure and electrode on main surface.

#### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

**6. Claim 6 recites the limitation "the wiring electrode" in lines 3-4.** There is insufficient antecedent basis for this limitation in the claim. Nowhere in any parent claim is a wiring electrode claimed.

#### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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**7. Claims 1-3, 8 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Gaalema (US 4,507,674).**

*Regarding claim 1*, Gaalema (Figure 1) teaches a photodetector device comprising:

a multilayer structure (10) including a plurality of compound semiconductor layers (18 and 20) laminated and having first and second main faces opposing each other;

a photodetecting region (19) formed near the first main face within the multilayer structure;

a first electrode (16) arranged on the first main face of the multilayer structure and electrically connected to the photodetecting region (column 4, ln 60 - column 5, ln 6);

a second electrode (28) arranged on the second main face of the multilayer structure and electrically connected to the first electrode (14, 16);

a third electrode (26) arranged on the second main face of the multilayer structure and electrically connected to a part near the second main face in the multilayer structure; and

a light transmitting layer (12), optically transparent (column 4, ln 56-59) to incident light and arranged on the first main face of the multilayer structure, covering the photodetecting region and first electrode.

*Regarding claim 2*, Gaalema teaches the light transmitting layer includes a film made of silicon oxide and a glass substrate (column 10, ln 65 - column 11, ln 8; silicon oxide is glass); and wherein the glass substrate is secured to the multilayer structure through the film made of silicon oxide (the glass itself is attached to itself, which is attached to the multilayer structure).

*Regarding claim 3*, Gaalema teaches the light transmitting layer includes a film made of silicon oxide or a resin (column 10, ln 65 - column 11, ln 8; silicon oxide is glass).

*Regarding claim 8*, Gaalema teaches a light-reflecting film (26; column 8, ln 45-51), provided on the second main face, covering the photodetecting region.

*Regarding claim 9*, Gaalema teaches a plurality of photodetecting regions arranged in a row (column 3, ln 21-25).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**8. Claims 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gaalema ('674) as applied to claim 1 above, and further in view of Yutaka et al. (JP 3-104287) of record.**

*Regarding claim 4*, Gaalema teaches the photodevice of claim 1, but fails to teach the plurality of compound semiconductor layers include a high-concentration carrier layer of a first conductive type, a light-absorbing layer of the first conductive type, and a cap layer of the first conductive type; and wherein the photodetecting region is a region of a second conductive type including at least a part of the cap layer.

However, Yutaka et al. teaches a photodetector device which comprises a plurality of compound semiconductor layers including a high-concentration carrier layer of first conductivity type (8), a light absorbing layer of first conductivity type (7), and a cap layer of first conductivity type (1 and 5); and wherein the photodetecting region (2) is a region of a second conductive type including at least part of the cap layer.

Therefore, it would have been obvious to construct the multilayer semiconductor region of Gaalema according to the construction set forth by Yutaka et al. for the purpose of accurately controlling the width of each layer by use of an epitaxial growth method (Abstract).

*Regarding claim 5*, Gaalema in view of Yutaka et al. teaches the multilayer structure

further comprises a depression (Gaalema: area inside 28) formed about the photodetecting region, and a wiring electrode (28) arranged within the depression; wherein the first electrode (16) is connected to the second electrode (28: top) through the wiring electrode; and

wherein the third electrode (26) is electrically connected to a part positioned near the photodetecting region in the high-concentration carrier layer (22 connected to 20, which in this case corresponds to Yutaka et al. high-concentration layer 8 in order of construction).

*Regarding claim 6*, Gaalema teaches a through lead (28) penetrating through the multilayer structure;

wherein the first electrode (16) is electrically connected to the second electrode (28) through the lead (28); and

wherein the third electrode (26) is electrically connected to the high-concentration carrier layer (22 connected to 20, which in this case corresponds to Yutaka et al. high-concentration layer 8 in order of construction).

**9. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gaalema ('674) as applied to claim 1 above, and further in view of Fujii et al. (US 6,933,489).**

*Regarding claim 7*, Gaalema teaches the second and third electrodes include respective pad electrodes (26 and 28: flat surfaces), and that second and third electrodes are attached to further circuitry (70 and 32).

Thus, Gaalema is shown to teach all the limitations of claim 7 with the exception of bump electrodes arranged on the pad electrodes.

However, Fujii et al. teaches an analogous backlit photodetector device in which bump electrodes (B) are attached to pad electrodes (OM) for the purpose of electrically and



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mechanically attaching the photodetecting device to a semiconductor chip (C; column 2, ln 51-67).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to attach bump electrodes to the electrodes of Gaalema in order to reduce packaging area, and connect multiple photodetectors to a single circuitboard without much loss of real estate.

**10. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gaalema ('674) as applied to claim 1 above, and further in view of Nunogaki et al. (US 5,602,384).**

*Regarding claim 10*, Gaalema teaches the light transmitting layer (12).

Thus, Gaalema is shown to teach all the limitations of claim 10 with the exception of a lens part converging the incident light.

However, Nunogaki teaches an analogous light detector which uses a glass lens (130) to direct light into a photodetecting region (Column 25, ln 54-63).

Therefore, it would have been obvious to one of ordinary skill in the art to use a glass lens to focus the light in order to maximize radiation absorption efficiency, and to increase sensor output for light even at oblique angles (Nunogaki et al. column 25, ln 64 – column 26, ln 9).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DIANA C. GARRITY whose telephone number is (571) 270-5026. The examiner can normally be reached on Monday-Friday 7:00 AM - 3:30 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Anh Mai can be reached on (571) 272-1710. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Diana C Garrity/  
Examiner, Art Unit 2814

/Anh D. Mai/  
Primary Examiner, Art Unit 2814